Biology of Pathways for Invasive Weeds

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Biology of Pathways for Invasive Weeds

"Invasive weeds possess a variety of characteristics that enable them to disperse rapidly into new areas and out-compete crops, or native or desirable non-native vegetation for light, water, nutrients and space." Westbrooks, 1998

Biology of Pathways for Invasive Weeds

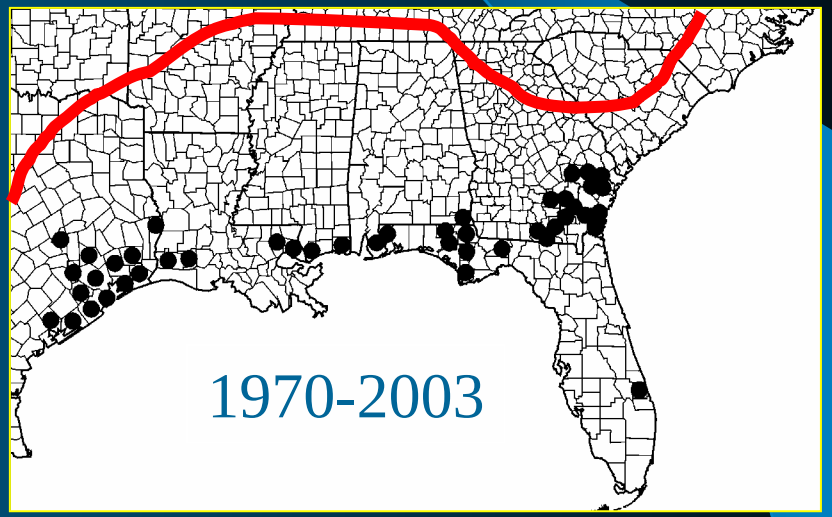
Biological processes and characteristics are the most important factor in the success of invasive weeds.

Biology of Pathways for Invasive Weeds

- Reproductive
- Dispersal
- Phenology
- Habitat
- Physiology
- Protection from herbivores
- Tolerance to environmental extremes
- Interspecific Interaction

Biology of Pathways: Reproductive

Copious production of seed

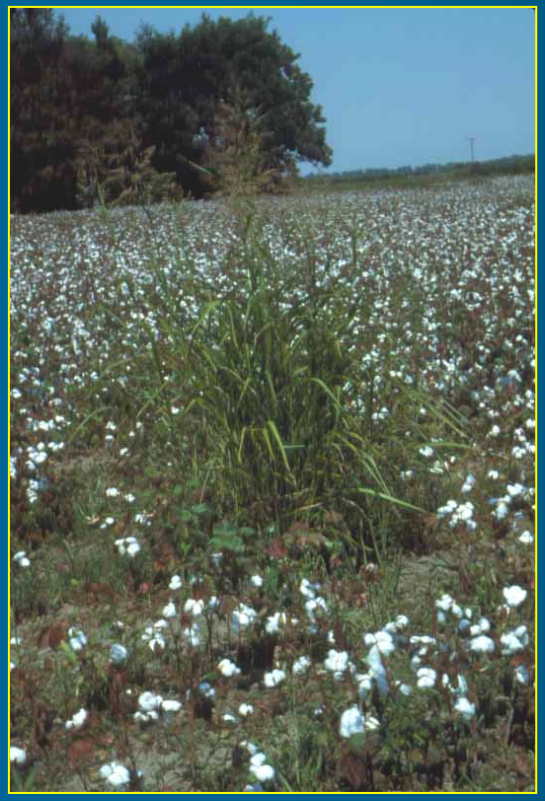


Deeprooted sedge (*Cyperus entrerianus* Boeckeler)

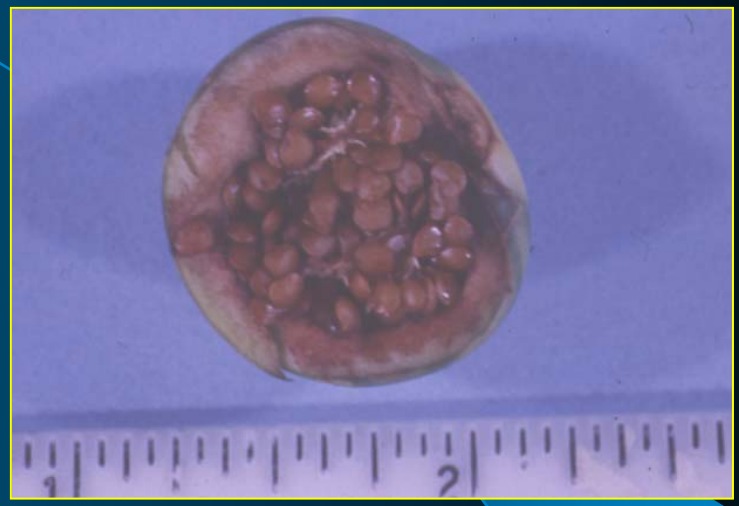
≥ 20 billion seed/ha

Biology of Pathways: Reproductive

Seed longevity



Johnsongrass
[*Sorghum halepense* (L.) Pers.]
Seed survival ≥ 15 years



Tropical Soda Apple
(*Solanum viarum* Dunal)
Many seed
Short dormancy

Biology of Pathways: Reproductive

Plant longevity and many seed produced annually

Silktree (*Albizia julibrissin* Durazz.)
Woody perennial

Biology of Pathways: Reproductive

Short life cycle
Multiple generations/year

Smallflower Umbrellasedge
(*Cyperus difformis* L.)
Seed to seed in 4 to 6 weeks

Herbicide resistance to bensulfuron
57 separate incidences in CA alone

Biology of Pathways: Reproductive

Asexual Reproduction

Fragmentation

Roots Rhizomes Stolons

Bulbs Tubers

False Umbrella Sedge
(*Cyperus prolifer* Lam.)

Purple Nutsedge
(*Cyperus rotundus* L.)
growth in 60 days

Biology of Pathways: Reproductive

Lag Phase

Critical mass to disperse and infest rapidly

Pilose Sedge
(*Cyperus pilosus* Vahl)
southeastern U.S.A.

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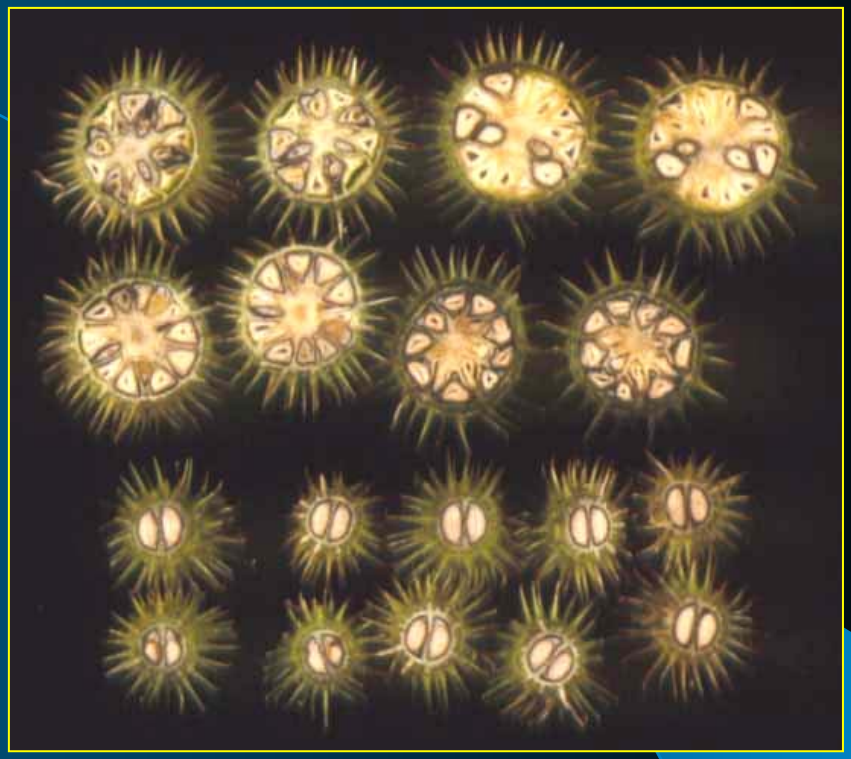
Biology of Pathways: Dispersal

Attachment to vector

Cyperus plukenetii Fern.
Small spikelets & seeds
Inflorescence shape



Common Cocklebur
(*Xanthium strumarium* L.)
Nature's Velcro
Multi-seeded

Biology of Pathways: Dispersal

Wind

Dandelion
(*Taraxacum officinale* Web. in Wigg.)

Cogongrass
[*Imperata cylindrica* (L.) Beauv.]

Biology of Pathways: Dispersal

Water & attachment to vector

Brown Flatsedge
(*Cyperus fuscus* L.)
Ballast
Birds
Flood waters
Construction equipment

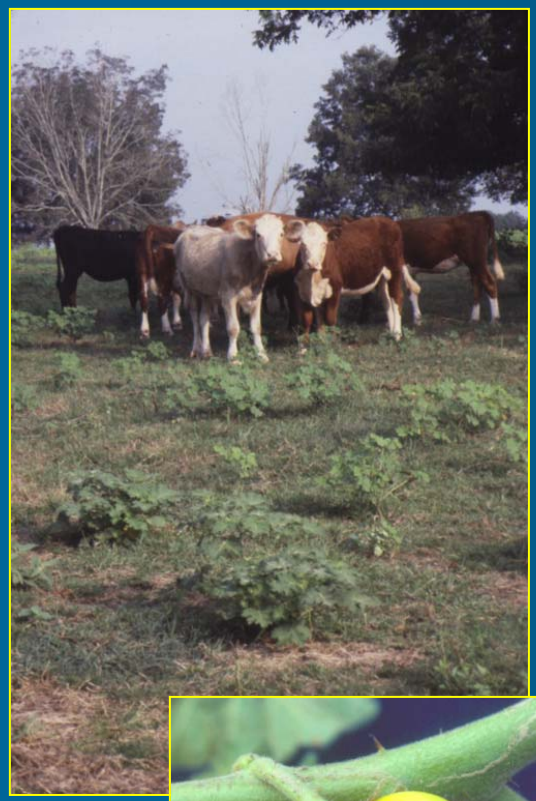
Biology of Pathways: Dispersal

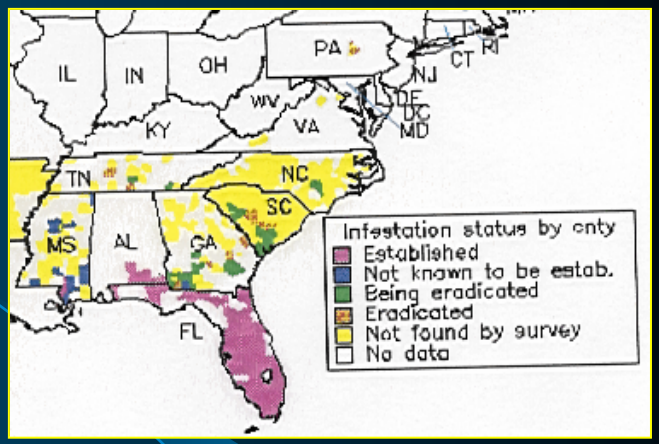
Attachment to vector

Yellow unicorn-plant
[*Ibicella lutea* (Lindl.) Van Eselt.]
Native to Brazil
Now in CA, FL, GA, MS

Biology of Pathways: Dispersal Vectors

Cattle & Wildlife





Tropical Soda Apple (*Solanum viarum* Dunal)

> 400 seed/fruit

≥ 500,000 ha infested since 1988 (9 states)

Biology of Pathways: Dispersal Vectors

Used as food by humans

Turkeyberry (*Solanum torvum* Dunal)
Native of Central America
Introduced into Asia

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Biology of Pathways: Phenology

Bloodscale Sedge (*Cyperus sanguinolentus* Vahl)
Flowering day/night length dependent (< 14 hr day)

Biology of Pathways: Phenology

Long's Sedge (*Carex longii* Mackenzie)
Flowering non-day/night length dependent; throughout the growing season

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Biology of Pathways: Habitat

Natural vs. disturbed areas

Japanese Honeysuckle
(*Lonicera japonica* L.)

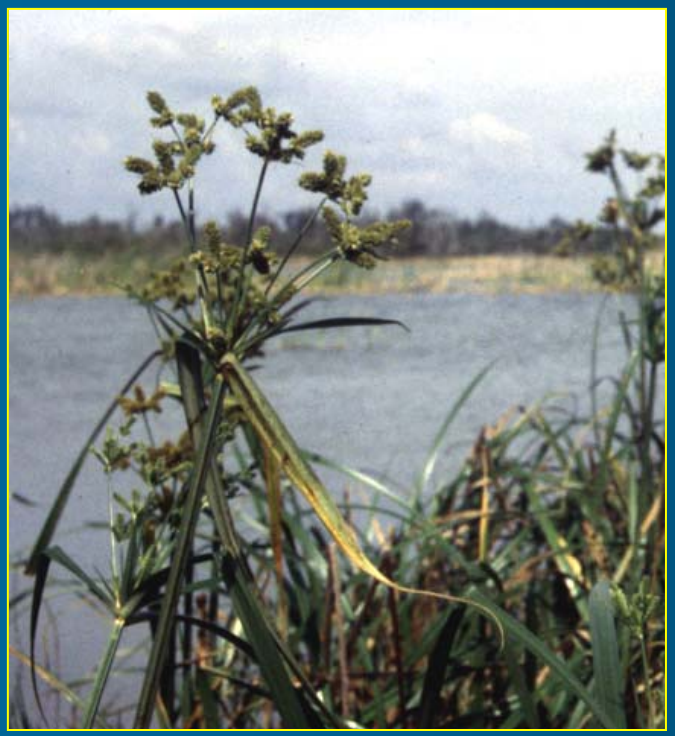
Chinese Tallow
[*Triadica sebifera* (L.) Small]

Invade Natural Areas

Purple Nutsedge
(*Cyperus rotundus* L.)
Invades disturbed areas

Biology of Pathways: Habitat

Favorable or suitable habitat



Foxtail Sedge
(*Cyperus alopecuroides* Rottb.)
Floating mats in Florida, U.S.A.

Salvinia sp.
Floating Fern

Swamp Morningglory
(*Ipomoea aquatica* L.)
Hollow, floating stems

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Biology of Pathways: Physiology

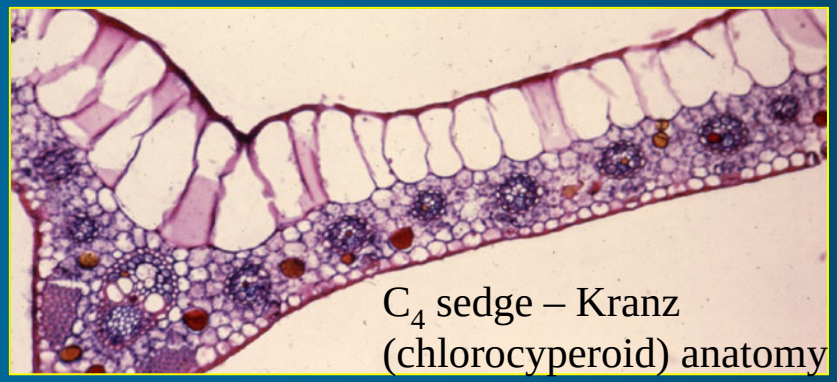
Production of chemicals that retard growth of other species - Allelopathy

Purple Nutsedge
(*Cyperus rotundus* L.)
World's Worst Weed

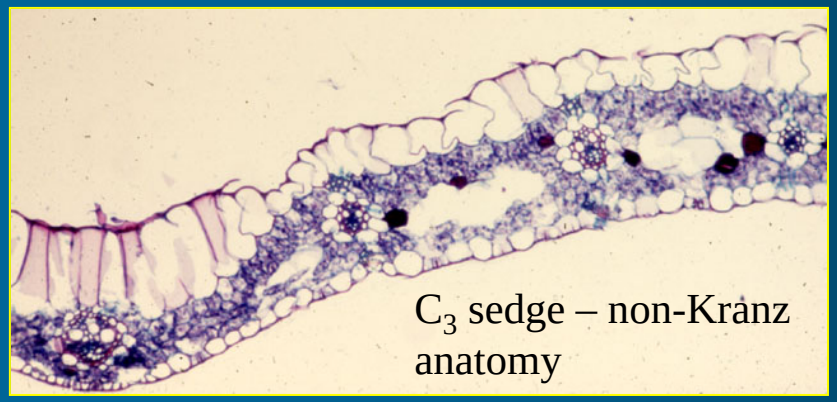
Biology of Pathways: Physiology

C_4 lower transpiration ratio than C_3 Plants

C_4 / C_3 is complex in Cyperaceae
(C_4 photosynthesis: four anatomical types
& two carbon assimilation modes)



C_4 sedge – Kranz (chlorocyperoid) anatomy



C_3 sedge – non-Kranz anatomy

Abildgaardia C_3/C_4
Fimbristylis C_3/C_4
Bulbostylis C_4
Cyperus C_3/C_4
- subg. *Cyperus* C_4
- subg. *Diclidium* C_4
- subg. *Juncellus* C_4
- subg. *Mariscus* C_4
- subg. *Pycreus* C_4
- subg. *Pycnostachys (=Protocyperus)* C_3
- subg. *Queenslandiella* C_4

Kyllinga C_4
Lipocarpha C_4
Bolboschoenus C_3
Eleocharis C_3/C_4
Fuirena C_3
Isolepis C_3
Oxycaryum C_3
Schenoplectus C_3
Scirpus C_3
Cladium C_3
Lepidosperma C_3
Rhynchospora C_3/C_4
Scleria C_3
Carex C_3

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Biology of Pathways: Protection from herbivores

- Hardened Seed Coat
- Stinging Hairs
- Glandular Hairs
- Glands
- Spines
- Thorns

Prickly Nightshades
Solanum sp.
5 native; 13 Non-Native in SE U.S.

Biology of Pathways: Protection from herbivores

- Chemical Repellants
- Toxins

Nipplefruit Nightshade
(*Solanum mammosum* L.)
Fruit pulp highly toxic

Rattlebush
[*Sesbania punicea* (Cav.) Benth.]
Seed toxic

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Biology of Pathways: Tolerance to environmental extremes

Cogongrass [*Imperata cylindrica* (L.) Beauv.]
80% of plant biomass underground
Fire at canopy top ≥700° F
Rhizomes fire resistant

Biology of Pathways: Tolerance to environmental extremes
Emerge through harsh environmental zone

Purple Nutsedge
(*Cyperus rotundus* L.)
Growing through asphalt

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Biology of Pathways: Interspecific Interaction

Crowds out competition

Kudzu
[*Pueraria montana* (Lour.) Merr.]
Climbs, covers, and kills

Hemp Sesbania
[*Sesbania exaltata* (Raf.) Rydb.]
Shade reduces cotton yields

Quickly, become knowledgeable about the plant's biological characteristics!

Determining the plant's most vulnerable stage of growth is *the most important factor* in developing control strategies.

Best Management Practices:

- **Prevention**
- **Early Detection**
- **Rapid Response**
- **Eradication (Small or isolated populations)**
- **Control Methods (Cultural & Herbicides)**